Names: ____

Interference of Light Lab
SPH4U

Purpose: To observe the interference pattern produced when different colours of light pass through a multiple-slit diffraction grating and to determine the wavelength of each.

Materials: Laser (red, $\lambda = 632.8$ nm), diffraction grating, metre stick, white paper (for screen and "sliders"), incandescent lamp, transparent plastic coloured filters, retort stand

Part 1: Determining Slit Separation

1. Direct the laser light through the multiple-slit grating towards a screen (white paper). Use the metre stick to measure the distance from the slits to the screen (L) and record your measurement in Table 1.
2. Use the metre stick (or a ruler) to measure the separation between maxima (Δx) . (Measure across at least 6 bright fringes on the screen.)

Show your first two measurements to your teacher and ask your teacher to initial here: ________

3. Repeat Steps 1 and 2 for four different distances between the grating and the screen.

Table 1: Separation between maxima for different distances between the grating and screen

L (m)					
Δx (m)					

4. Graph your data in the table above with L on the horizontal axis and Δx on the vertical. Calculate the slope of your line of best fit on your graph.

5. Use your slope and the equation $\Delta x = \frac{\lambda L}{d}$ (and the wavelength of the light, given above) to determine the slit separation. Show your calculation below.

Show your calculation to your teacher and ask your teacher to initial here: _________

Part 2: Determining Wavelength

1. Set up your apparatus as shown on p. 486 of "Nelson Physics 12". You may find it easier to place the lamp on the bottom of the stand and slide the metre stick down.

2. View the lamp filament through the grating. Describe the pattern seen on either side of the lamp filament:

   ____

   ____

   ____

3. Place either the red, green, or blue filter over the diffraction grating. (Why don't you want to use the yellow filter?) View the lamp filament through the grating. Move the sliders to mark the positions of two maxima and count the number of maxima between them. Determine Δx and record this measurement in Table 2.

4. Repeat Steps 2 and 3 for four different distances between the grating and the filament.

Table 2: Separation between maxima for the ___________-filtered grating and filament

L (m)					
Δx (m)					

5. Graph your data in the table above with L on the horizontal axis and Δx on the vertical. Calculate the slope of your line of best fit on your graph.

6. Use your slope and the equation $\Delta x = \frac{\lambda L}{d}$ (and the slit separation, calculated previously) to determine the wavelength of the light. Show your calculation below.

Show your calculation to your teacher and ask your teacher to initial here: _________

7. Repeat Steps 2 through 4 for a different coloured filter. Record your data in Table 3.

Table 3: Separation between maxima for the ___________-filtered grating and filament

L (m)					
Δx (m)					

8. Graph your data in the table above with L on the horizontal axis and Δx on the vertical. Calculate the slope of your line of best fit on your graph.

9. Use your slope and the equation $\Delta x = \frac{\lambda L}{d}$ (and the slit separation, calculated previously) to determine the wavelength of the light. Show your calculation below.

Show your calculation to your teacher and ask your teacher to initial here: _________

Discussion Questions

1. Are the wavelengths you determined what you would expect for those colours of light? Why might the light viewed through the red filter be a different wavelength than the red light from the laser?

2. Use your measurements of Δx for the different wavelengths to explain your observation when viewing the white light through the grating.

Show your answers to your teacher and ask your teacher to initial here: _________